Hypothesis Concerning the Dynamics of Ice Crystal Formation in Sublimation

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Introduction

The particular shapes in which water-ice crystals form continues to pose somewhat of a mystery for researchers. By understanding the formation of these crystals, we can gain insight into nano- scale phonon and heat conduction dynamics.

Abstract

Although, in some cases, ice crystal shape is governed by the shape of the initial nuclear particle around which water condenses, in sublimation, other dynamics cause the pattern of crystal development to repeatedly change in the context of the formation of a single crystal.

Of particular interest are the dynamics of the formation of branching parallel lines of water-ice which resemble the needles of a coniferous tree extending from a branch. I propose that these lines are the byproduct two primary factors: 1.) Heat is generated by the sublimation process, which occurs at the extremity of the forming branches. 2.) This heat is reflected by the established ice, which has a lower density than liquid water. Because of this lower density, reflection of heat occurs and this forces the water at the extremity of the branch to remain liquid. As a result of this liquid state, water vapor in the air adheres to this liquid tip of the branch more readily than it does to entirely frozen portions, which do not have surface tension, in contrast with the liquid portion.

If the hyperlocal water vapor content of the air decreases for any reason, it can result in the complete freezing of the extremity of each of the branches, resulting in, potentially, the formation of a new branch or set of branches moving in a different direction.

Conclusion

This provides the useful insight that where there is a waxing formation of a frozen material, heat and sound are deflected. Where there is a waning formation of a frozen material, as in evaporation or vaporization, heat and sound are absorbed.